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(54) Method for making hosiery items or tubular knitted items in general with a closed toe by using a single-cylinder circular machine

(57) A method for making hosiery items, or tubular knitted items in general, which have a closed toe by using a single-cylinder circular machine. The method comprises at least one first step, in which the needle cylinder (1) is actuated with an alternating rotary motion about its own axis (1a) to form a pocket (2) with heel- or toe-type knitting, using a set of needles (3a) located in one half of the needle cylinder (1), and a second step, in which the needle cylinder (1) is actuated with a continuous motion in order to form a tubular portion of the item. Before the beginning of the second step, at least one of

the initial rows of knitting (4) formed in the first step, which is arranged inside the needle cylinder (1) at the end of the first step along a chord which runs between the two end needles (3'a) of the set of needles (3a) used in the first step, is engaged, starting from one of the two end needles (3'a), and gradually moved above the needles (3b) located in the other half of the needle cylinder (1) and knitted in by them with the first row of knitting (4) formed at the beginning of the second step.

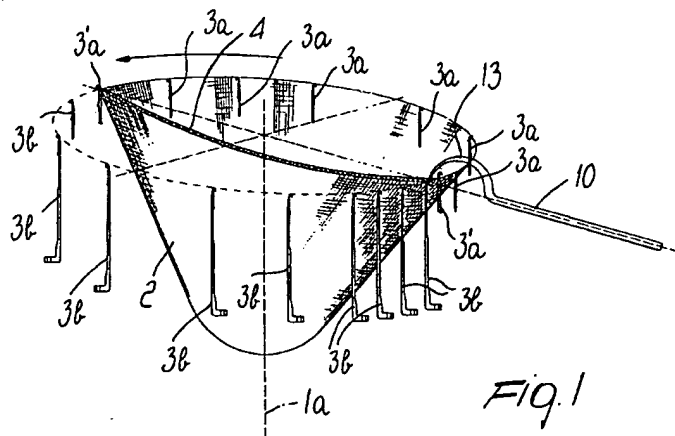


Fig. 1

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Description

The present invention relates to a method for making hosiery items or tubular knitted items in general with a closed toe by using a single-cylinder circular machine.

It is known that the method currently used to manufacture hosiery items with single-cylinder circular machines substantially consists in initially forming the top or trimming of the hosiery item, which is arranged at the upper end of the leg of the item, optionally by using the circular plate to obtain a double trimming having a tubular structure, and in subsequently producing a tubular portion of knitting by actuating the needle cylinder with a continuous rotary motion about its own axis. The needle cylinder is then actuated with an alternating rotary motion about its own axis, using only the needles of one half of the needle cylinder, gradually decreasing and then gradually increasing the number of active needles, so as to obtain a pocket which constitutes the heel of the hosiery item. After the formation of the heel, the needle cylinder is again actuated with a continuous rotary motion about its own axis, forming an additional tubular portion which constitutes the foot of the hosiery item, and knitting is completed by forming the toe of the hosiery item with a knitting which is similar to that of the heel. The resulting hosiery item is then unloaded with its toe still open and is then seamed or looped in order to close the toe.

Another method for producing hosiery items with single-cylinder circular machines, which is known but less used than that previously described, consists in producing the hosiery item by starting from its toe rather than from its leg.

In practice, according to this method, the needle cylinder of the machine is initially actuated with an alternating rotary motion about its own axis, using only the needles of one half of the needle cylinder and first gradually decreasing the number of said needles and then gradually increasing the active needles so as to form a pocket with a knitting which is similar to the formation of a heel constituting the toe of the sock.

The needle cylinder of the machine is then actuated with a continuous rotary motion about its own axis and the needles of the other half of the needle cylinder are also used so as to obtain a portion of tubular item which constitutes the foot of the hosiery item.

After the formation of this tubular portion, the needle cylinder of the machine is again actuated with an alternating rotary motion about its own axis, in a manner similar to the actuation performed during the formation of the toe of the hosiery item, in order to form the heel of the hosiery item and is then again actuated with a continuous rotary motion about its own axis in order to form an additional tubular portion which constitutes the leg of the hosiery item.

In any case, both of these methods produce hosiery items which, at the end of their knitting on the single-cylinder circular machine, are open at the toe and must

therefore be subjected to additional seaming or looping operations in order to finish the hosiery item, entailing additional costs.

Because of this, methods and devices have been proposed in recent years for closing the toe of hosiery items directly in the single-cylinder circular machine producing them.

However, these methods and devices, despite being able to produce finished hosiery items, i.e., hosiery items in which the toe is closed directly on the machine that makes them, have the problem that they significantly slow the production cycle of the machine and therefore excessively affect the production costs of the hosiery items.

Moreover, the devices required to close the toe of the hosiery items directly on the single-cylinder circular machine very often complicate the structure of the machine excessively, in many cases limiting its production versatility since in order to install these devices it is necessary to renounce other devices required to perform particular knitting operations required by the purchaser.

The principal aim of the present invention is to solve the above problems by providing a method which allows to produce hosiery items or tubular items in general which have a closed toe with a single-cylinder circular machine without excessively penalizing the productivity of the machine.

Within the scope of this aim, an object of the invention is to provide a method which allows to produce hosiery items or tubular items in general which have a closed toe with a degree of finish which is acceptable from an aesthetic point of view.

Another object of the invention is to provide a method which can be performed with structurally simple devices which can be installed on conventional-type single-cylinder circular machines without penalizing the possibility of installing other devices which are usually installed in these machines.

Another object of the invention is to provide a device easy to install in single-cylinder circular machines of the conventional type to carry out the method according to the invention.

This aim, these objects and others which will become apparent hereinafter are achieved by a method for making hosiery items or tubular items in general which have a closed toe by using a single-cylinder circular machine, comprising at least one first step, in which the needle cylinder is actuated with an alternating rotary motion about its own axis to form a pocket with heel- or toe-type knitting, using a set of needles located in one half of the needle cylinder, and a second step, in which the needle cylinder is actuated with a continuous rotary motion in order to form a tubular portion of the item, characterized in that at the end of said first step and before said second step, at least one of the initial rows of knitting formed in said first step, which is arranged inside the needle cylinder at the end of said first step

along a chord which runs between the two end needles of the set of needles used in said first step, is engaged, starting from one of said two end needles, and gradually moved above the needles located in the other half of the needle cylinder and knitted in by them with the first row of knitting formed at the beginning of said second step.

Further characteristics and advantages of the invention will become apparent from the description of a preferred but not exclusive embodiment of the method according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figures 1 to 3 are schematic views of the gradual positioning of the row or rows of knitting, formed at the beginning of the first step with the needles of one half of the needle cylinder, above the needles of the other half of the needle cylinder before the beginning of the second step of the method;

figure 4A is a sectional view of a detail of the circular plate of the knitting machine;

figures 4 to 7 are schematic sectional views of the machine, taken along a vertical plane which passes through the needle cylinder axis, showing the operating sequence for positioning the row or rows of knitting, formed at the beginning of the first step with the needles of one half of the needle cylinder, above the needles of the other half of the needle cylinder;

figure 8 is a sectional view, taken similarly to figures 4 to 7, of a different embodiment of the engagement means for positioning the row or rows of knitting, formed at the beginning of the first step with the needles of one half of the needle cylinder, above the needles of the other half of the needle cylinder;

figure 9 is a schematic front view of the engagement means shown in figure 8, taken from the outside of the needle cylinder, in which the arrangement of the needles is projected onto a plane;

figures 10 and 11 are schematic perspective views of the positioning of the row or rows of knitting in a step which directly precedes the beginning of the first step of the method.

With reference to the above figures, the method according to the invention comprises, in a manner similar to the methods for forming hosiery items on single-cylinder circular machines which entail starting the knitting from the toe of the hosiery item, at least one first step in which the needle cylinder, generally designated by the reference numeral 1, is actuated with an alternating rotary motion about its own axis 1a to form a pocket 2, performing heel- or toe-like knitting, by using a set of needles 3a, 3'a located in one half of the needle cylinder 1.

The method comprises, in a per se known manner, at least one second step during which the needle cylinder

1 is actuated with a continuous rotary motion about its own axis 1a in order to form a tubular portion of the item.

At least one row of knitting 4 of the rows of knitting formed at the beginning of the first step of the method is preferably formed with pre-tensioned elastic thread or threads.

Preferably, three or four rows of knitting, instead of a single row of knitting 4, are formed at the beginning of the first step of the method using one or more pre-tensioned elastic threads.

In this manner, at the end of the first step, the row or rows of knitting 4 formed with one or more pre-tensioned elastic threads are engaged, at their longitudinal ends, with the end needles 3'a of the set of needles located in the half of the needle cylinder which has been used to form the pocket 2. The row or rows of knitting 4, being formed by means of one or more pre-tensioned elastic threads, are arranged, at the end of the first step of the method, along a chord which is more or less taut according to the pre-tensioning of the elastic thread or threads, inside the needle cylinder.

At the end of the first step and before the second step, the row or rows of knitting 4 are engaged, starting from one of the two end needles 3'a between which said row or rows 4 is arranged, and are carried above the needles 3b located in the other half of the needle cylinder. Through the successive actuation of said needles so as to form knitting, at least one of the rows of knitting 4 is gradually crossed by the needles 3b and knit in by them with the first row of knitting formed at the beginning of the second knitting step.

The row or rows of knitting 4 can be positioned above the needles 3b of the other half of the needle cylinder by using engagement means which are arranged proximate to the upper end of the needles and are stationary with respect to the rotary motion of the needle cylinder about its own axis 1a, even using, for the positioning of said row or rows of knitting 4, the rotary motion itself of the needle cylinder about its own axis 1a.

The means for engaging the row or rows of knitting 4 can be constituted, as shown in particular in figures 1 to 7, by a hook 10 which can move on command along a direction 11 which is substantially parallel to the axis 1a of the needle cylinder and along a direction 12 which lies radially with respect to the needle cylinder 1.

The hook 10 is preferably provided with a tip 13 which is directed toward the needle cylinder and downward so as to simply and safely engage the row or rows of knitting 4 as a consequence of its actuation along the directions 11 and 12, as shown in particular in figures 4 to 7.

In practice, at the end of the first step of the method, i.e., after the heel- or toe-like pocket 2 has been formed, the hook 10 is actuated in a radial direction with respect to the needle cylinder and parallel to the axis 1a of the needle cylinder, so as to engage the row or rows of knit-

ting 4 and gradually move said row or rows 4 above the needles 3b of the other end of the needle cylinder. During this step, the movement of the hook 10 is synchronized with the rotation of the needle cylinder 1 about its own axis 1a, so as to achieve a sufficiently precise and reliable positioning of the row or rows 4 above the needles 3b of the other half of the needle cylinder.

It should be noted that the number of actions of the hook 10 on the row or rows 4, i.e., the distance between two regions of the row 4 which are engaged in succession, in order to move it onto the needles 3b can vary according to the requirements.

The needles 3b, once the row or rows 4 have been moved above them, are raised so as to pass through said row or rows 4 and engage the thread fed by one of the feeds of the machine, knitting in the row or rows 4 with the first row of knitting formed by said needles at the beginning of the second step of the knitting.

The means for engaging the row or rows 4, as shown by the variation illustrated in figures 8 and 9, can also be simply constituted by a wheel 20 provided with radial teeth 20a and can rotate on command about its own axis 21, which is preferably orientated radially with respect to the needle cylinder. Said wheel is arranged at the upper end of the needle cylinder in the needle work area.

The combined rotation of the wheel 20 about its own axis 21 and of the needle cylinder 1 about its own axis 1a, starting from one of the end needles 3'a between which the row or rows 4 lie, makes the teeth 20a of the wheel 20 gradually engage successive portions of the row or rows 4, moving the row or rows 4 above the needles 3b of the other half of the needle cylinder.

In this case, too, the needles 3b, with the row or rows of knitting 4 thus arranged, are raised so as to pass through the row or rows 4 and engage the thread fed at a feed of the machine, forming the first row at the beginning of the second knitting step; said first row is thus knitted in with the row or rows 4.

For the sake of completeness in description, it should be noted that figure 4A illustrates the circular plate of the machine, designated by the reference numeral 30, and figures 4 to 8 illustrate a casting-off sinker, designated by the reference numeral 31.

The knitting of the hosiery item can be completed, in a per se known manner, by forming, after the second step, a heel by means of an alternating rotation of the needle cylinder about its own axis, using the needles of one half of the needle cylinder, and then producing an additional tubular portion, which constitutes the leg of the hosiery item, by actuating the needle cylinder with a continuous rotary motion about its own axis 1a and then optionally forming the trimming before unloading the hosiery item, which is thus produced directly by the single-cylinder circular machine with a closed toe.

In this manner, the need to subject the hosiery item to subsequent treatments in order to finish it is avoided.

In practice, it has been observed that the method according to the invention fully achieves the intended aim and objects, since it allows to produce, on single-cylinder circular machines and without excessively penalizing the productivity of the machine, hosiery items in which the toe is closed directly during their production, thus avoiding the additional costs related to the finishing operations, i.e., the operations for closing the toe, which are required by conventional-type hosiery item production methods.

The row or rows of knitting 4 are formed with one or more pre-tensioned elastic threads, which are dispensed in a known manner by a thread guide G: it has been noted that in some cases, before the beginning of the second step of the method the edge of the knitting tends to slightly roll up around the row 4 made of elastic thread which is arranged along the more or less taut chord inside the needle cylinder.

In relation to this, the step for knitting in with the first row of knitting formed at the beginning of the second step can be performed badly, since the hook 10 can engage a previous row instead of the last row 4 made of elastic thread.

In order to prevent this roll-up and consequent incorrect knitting-in, measures are taken to reduce the cylinder angle over which the row 4, which is arranged in a chord-like fashion between two end needles 3'a of the set of needles, is stretched; this is done by lowering the thread guide that dispenses the elastic thread at least once in an intermediate position with respect to the subtended angle, thus making a certain position of the row 4 to be engaged by the needle 3b' that corresponds to that certain position (from the inactive configuration shown in figure 10 to the active configuration shown in figure 11): this engagement of the row 4 with the needle 3b' is performed in a step which occurs directly before the beginning of the second step of the method.

It should be noted that although the method according to the invention has been conceived in particular for making hosiery items, it can more generally be used to produce tubular items in general which are closed at one of their ends on single-cylinder circular machines.

The method thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept: furthermore all the details may be replaced with other technically equivalent machines. In practice, the materials employed, as well as the dimensions, may be any according to requirements and the state of the art.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A method for making hosiery items, in particular tubular knitted items which have a closed toe by using a single needle cylinder circular machine, comprising at least one first step, in which the needle cylinder (1) is actuated with an alternating rotary motion about its own axis (1a) to form a pocket (2) with heel- or toe-type knitting, using a set of needles (3a) located in one half of the needle cylinder (1), and a second step, in which the needle cylinder (1) is actuated with a continuous rotary motion in order to form a tubular portion of the item, characterized in that at the end of said first step and before said second step, at least one of the initial rows (4) of knitting formed in said first step, which is arranged inside the needle cylinder (1) at the end of said first step along a chord which runs between the two end needles (3'a) of the set of needles (3a) used in said first step, is engaged, starting from one of said two end needles (3'a), and gradually moved above the needles (3b) located in the other half of the needle cylinder (1) and knitted in by them with the first row (4) of knitting formed at the beginning of said second step.
2. A method according to claim 1, characterized in that said at least one row of knitting is formed with a pre-tensioned elastic thread or threads.
3. A method according to claim 1, characterized in that said at least one row of knitting (4) comprises three or four rows produced with pre-tensioned elastic thread or threads.
4. A method according to one or more of the preceding claims, characterized in that said at least one row (4) is engaged by engagement means (10, 20) which are stationary with respect to the rotary motion of the needle cylinder about its own axis.
5. A method according to one or more of the preceding claims, characterized in that in a step which directly precedes the beginning of the second step, said at least one row of knitting (4) which lies in a chord-like fashion is engaged in at least one intermediate position with the needle that corresponds to said position, in order to avoid roll-up around said at least one row of knitting and consequent incorrect knitting-in.
6. A device for performing the method according to one or more of the preceding claims, characterized in that it comprises engagement means (10, 20) for said at least one row (4) of knitting, which lies in a chord-like fashion between two end needles (3'a) of the set of needles (3a) arranged in one half of the needle cylinder (1), said engagement means (10, 20) being actuatable on command in order to gradually move, starting from one of said two end needles (3'a), said at least one row (4) of knitting above the needles (3b) arranged in the other half of the needle cylinder (1).
7. A device according to claim 6, characterized in that said engagement means (10) are arranged laterally to the needle cylinder (1) of the machine, proximate to its upper end, and are stationary with respect to the rotary motion of the needle cylinder (1) about its own axis (1a).
8. A device according to one or more of the preceding claims, characterized in that said engagement means comprise a hook (10) which can move on command with respect to the needle cylinder (1) along a radial direction (12) and along an axial direction (11).
9. A device according to one or more of the preceding claims, characterized in that said engagement means comprise a wheel (20) having radial teeth (20a) which can engage said at least one row of knitting (4), said wheel being able to rotate about its own axis (21), which lies substantially radially with respect to the needle cylinder (4), and being arranged at the upper end of the needle cylinder (1) in the needle work area.

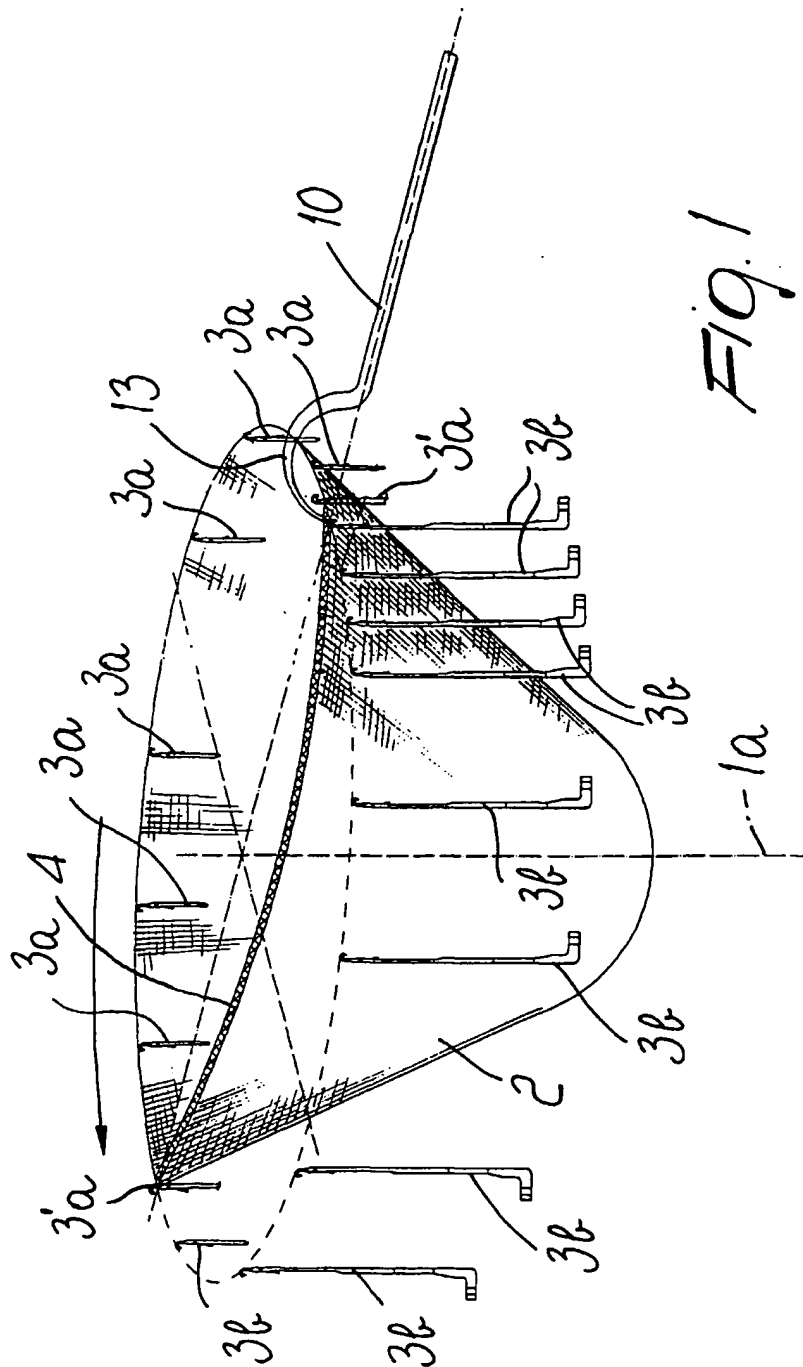
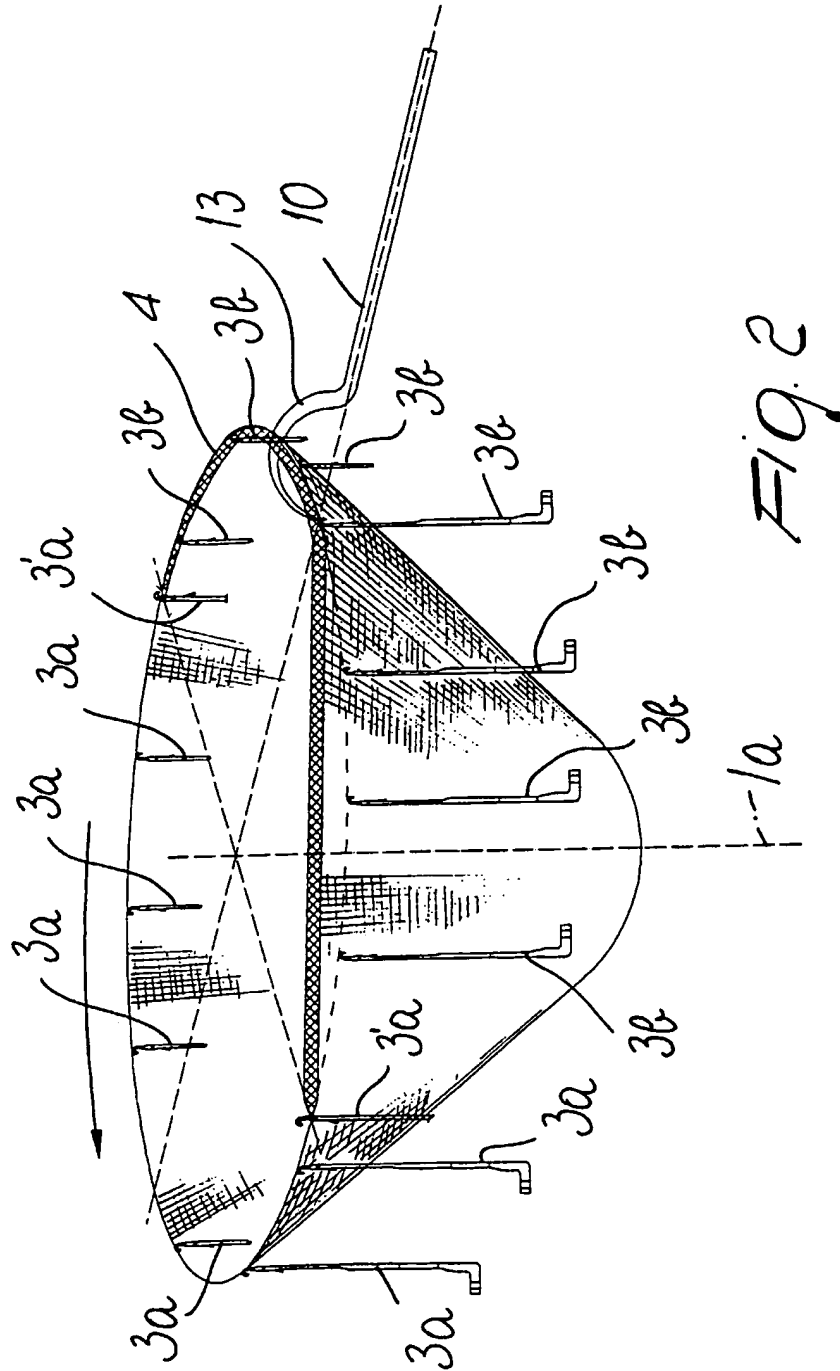
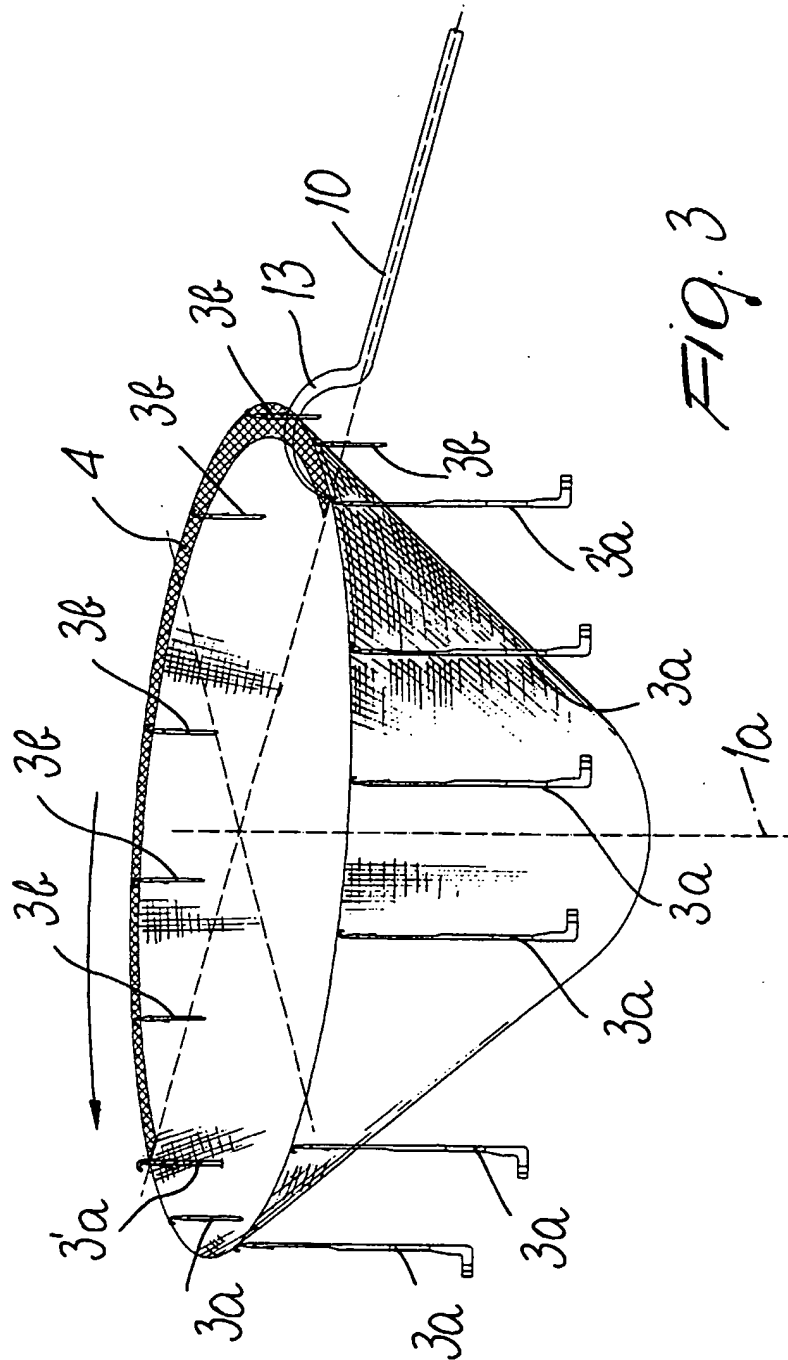
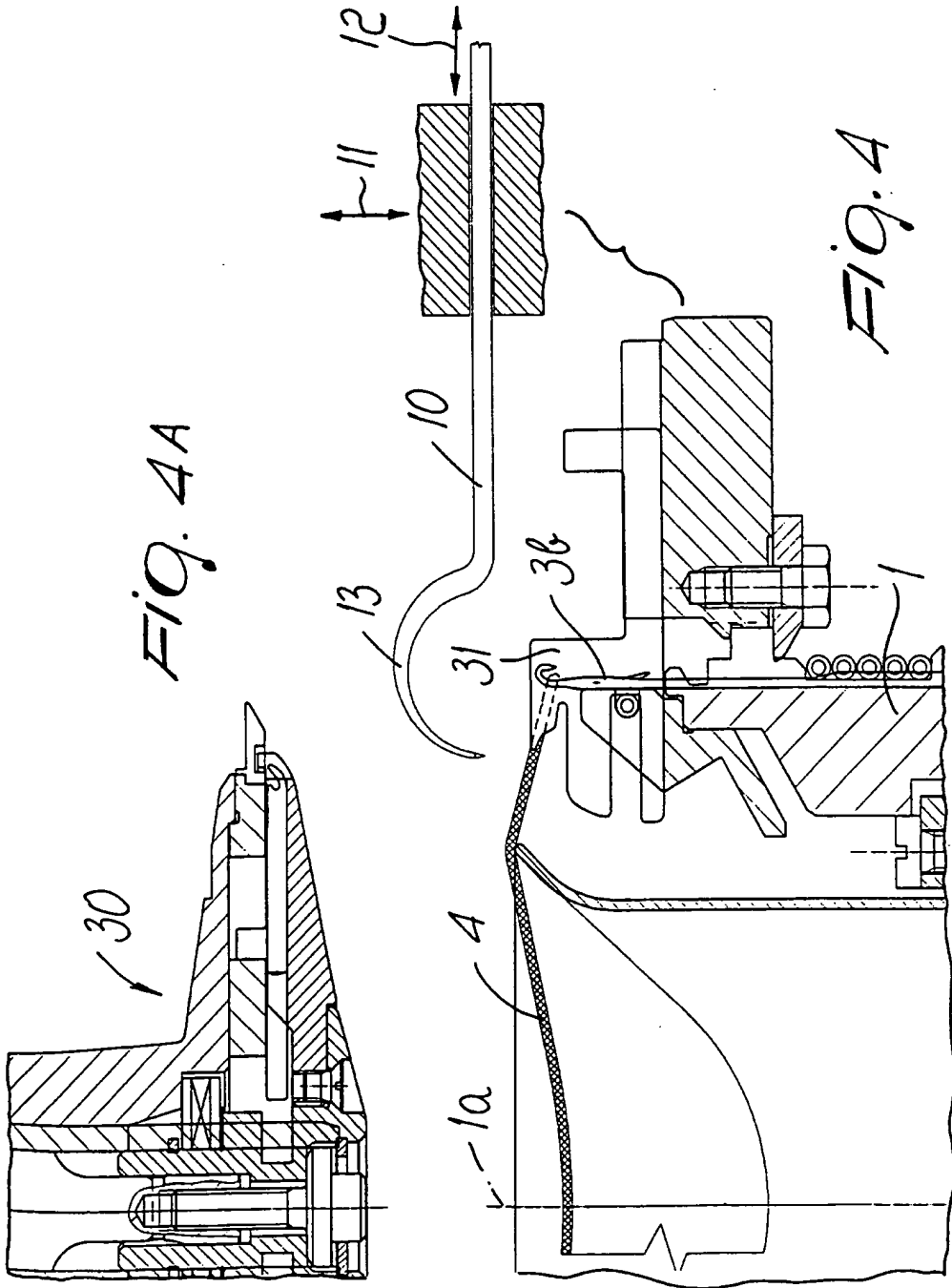


Fig. 1







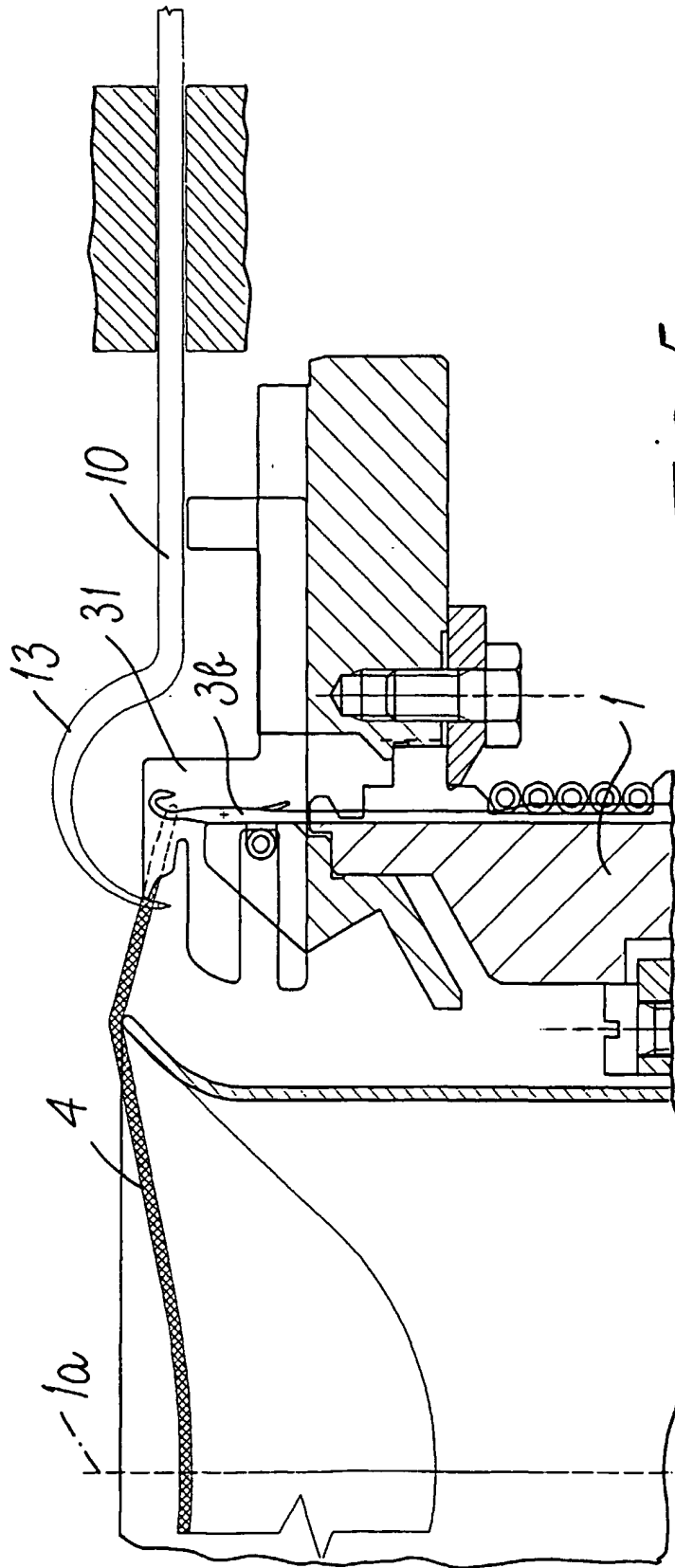
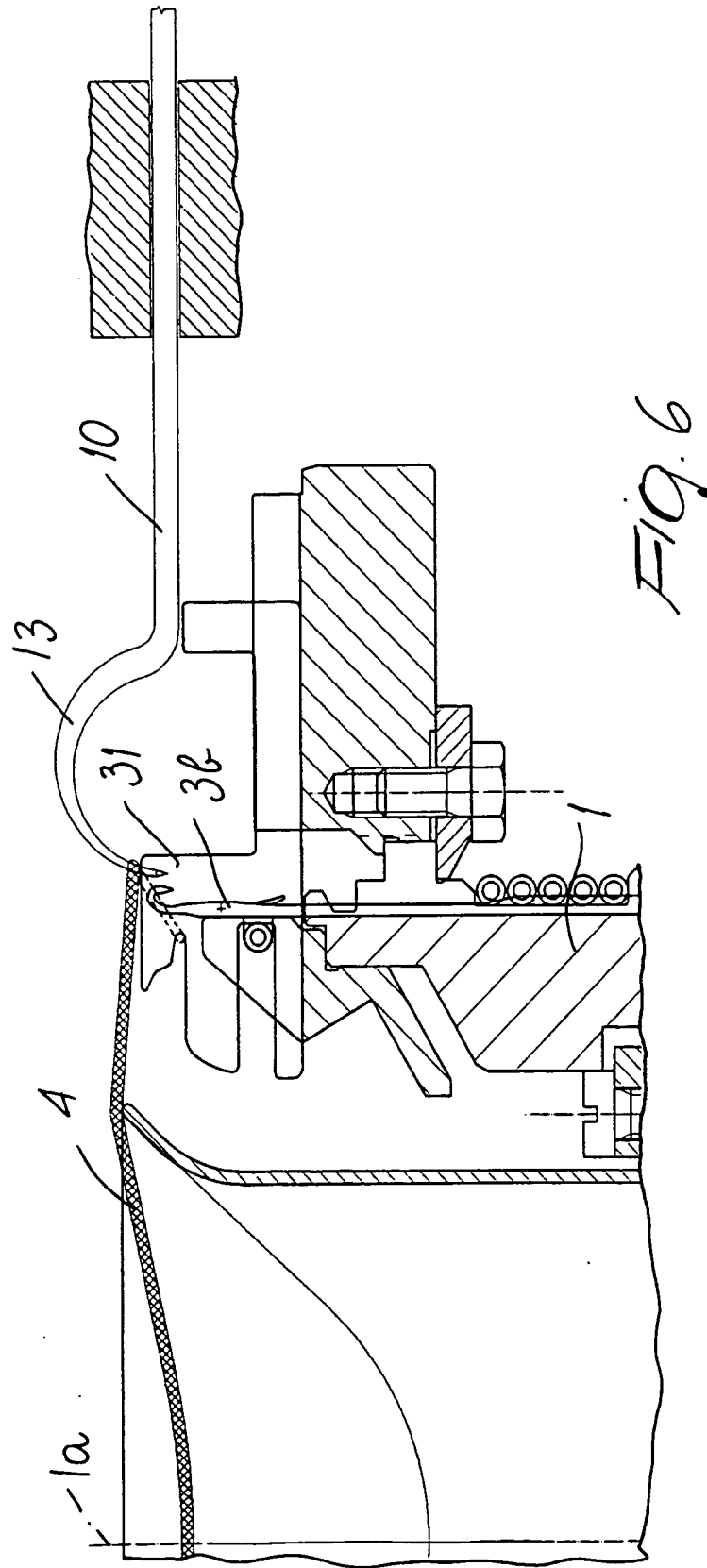
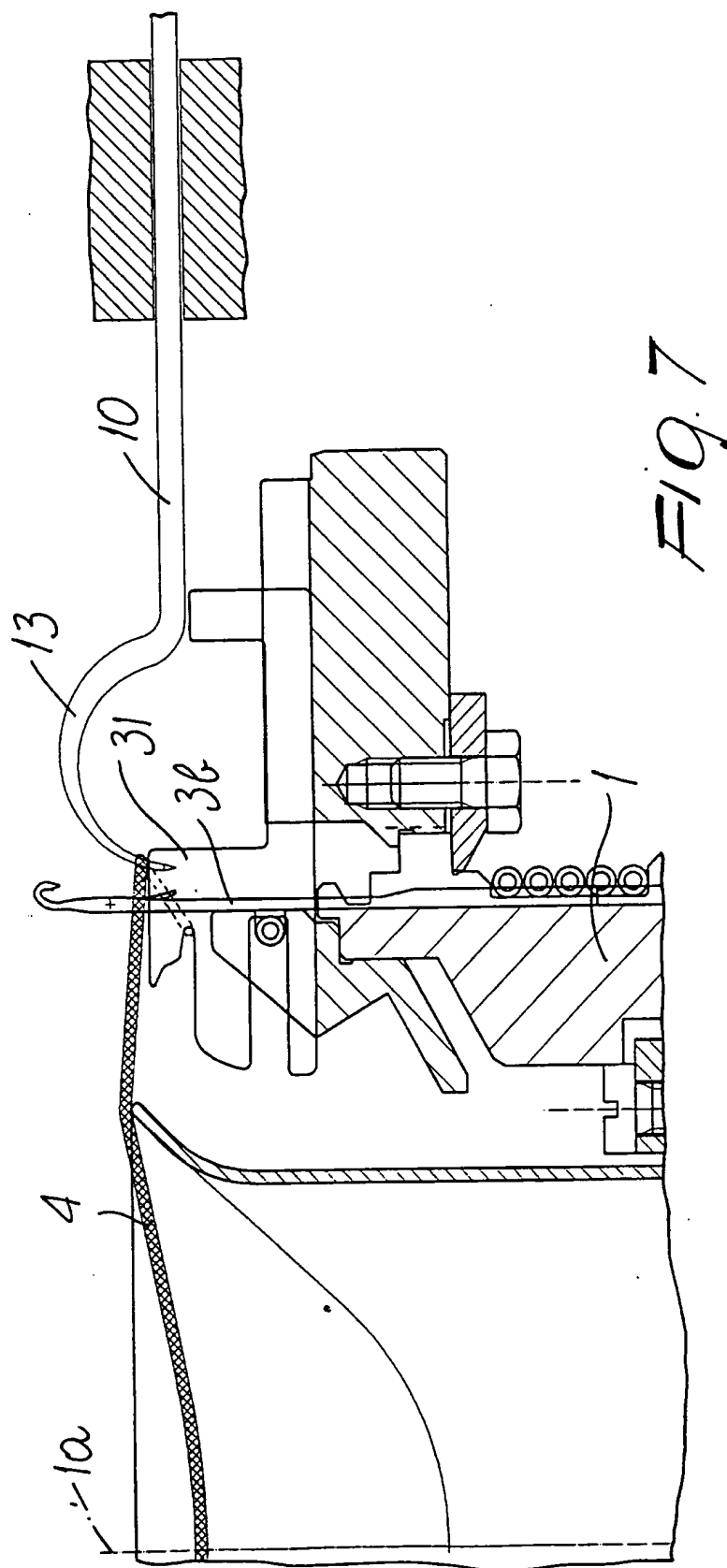
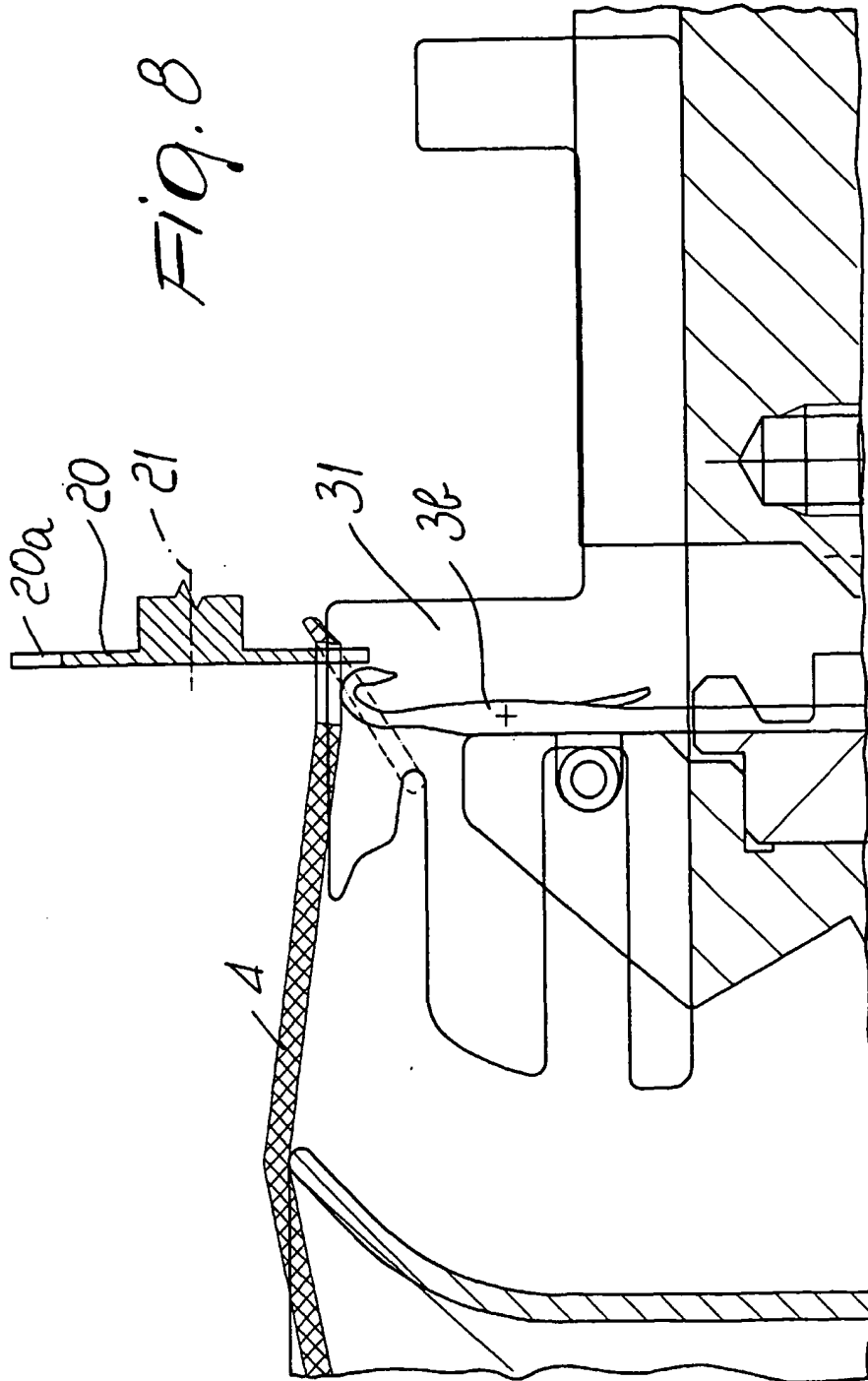


Fig. 5







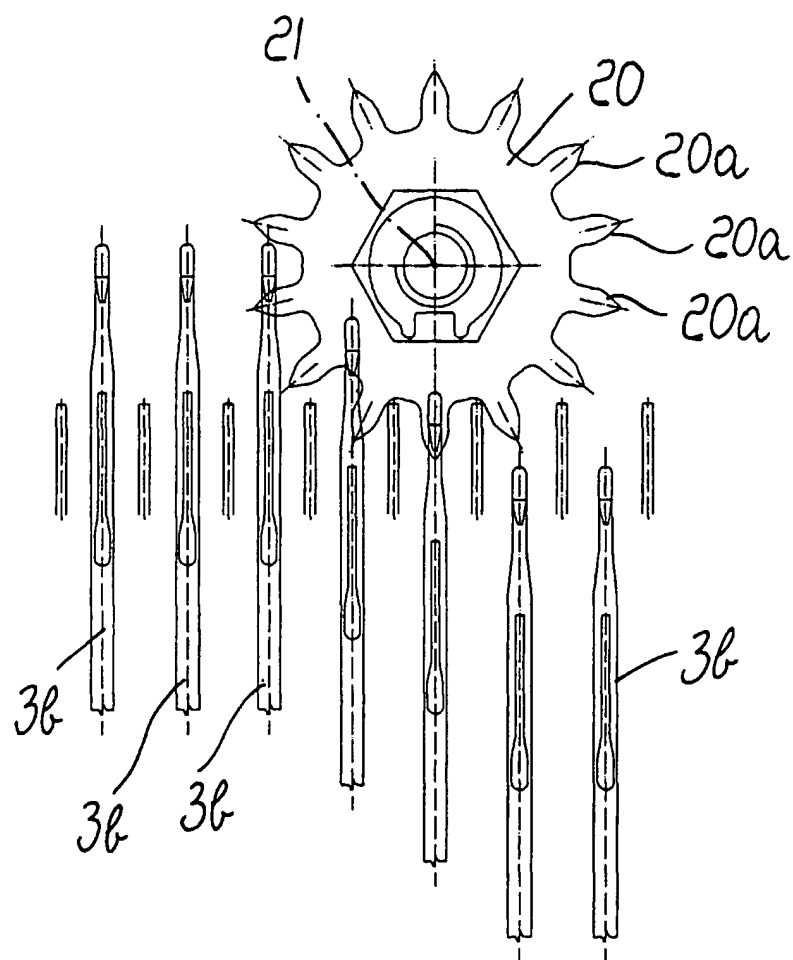


Fig. 9

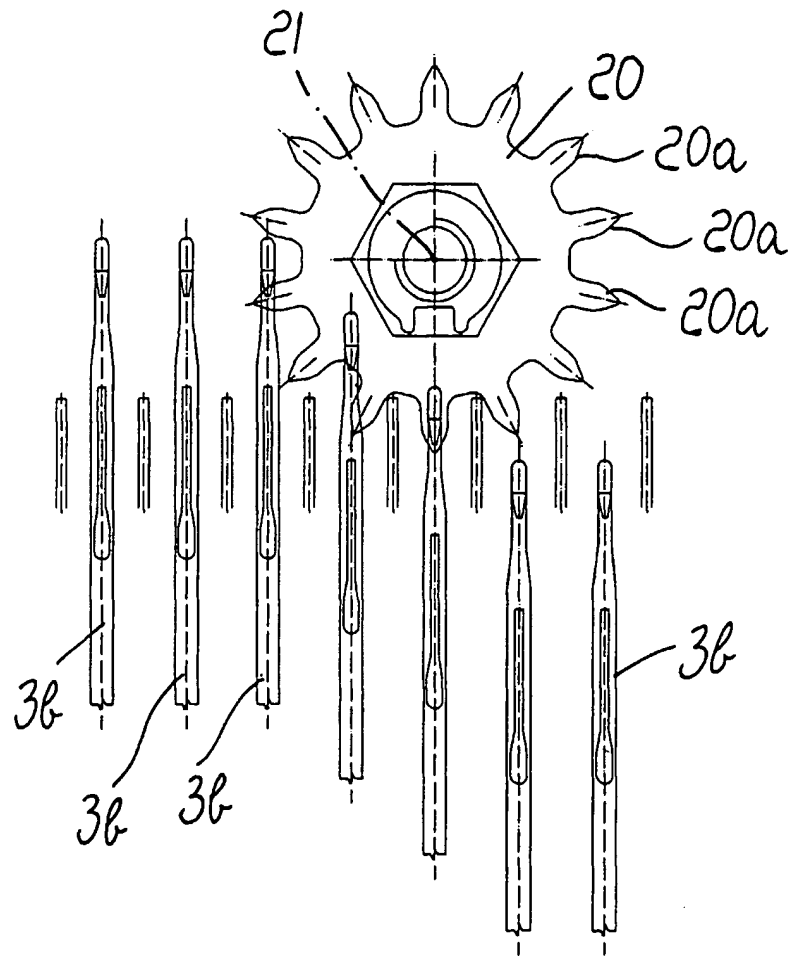
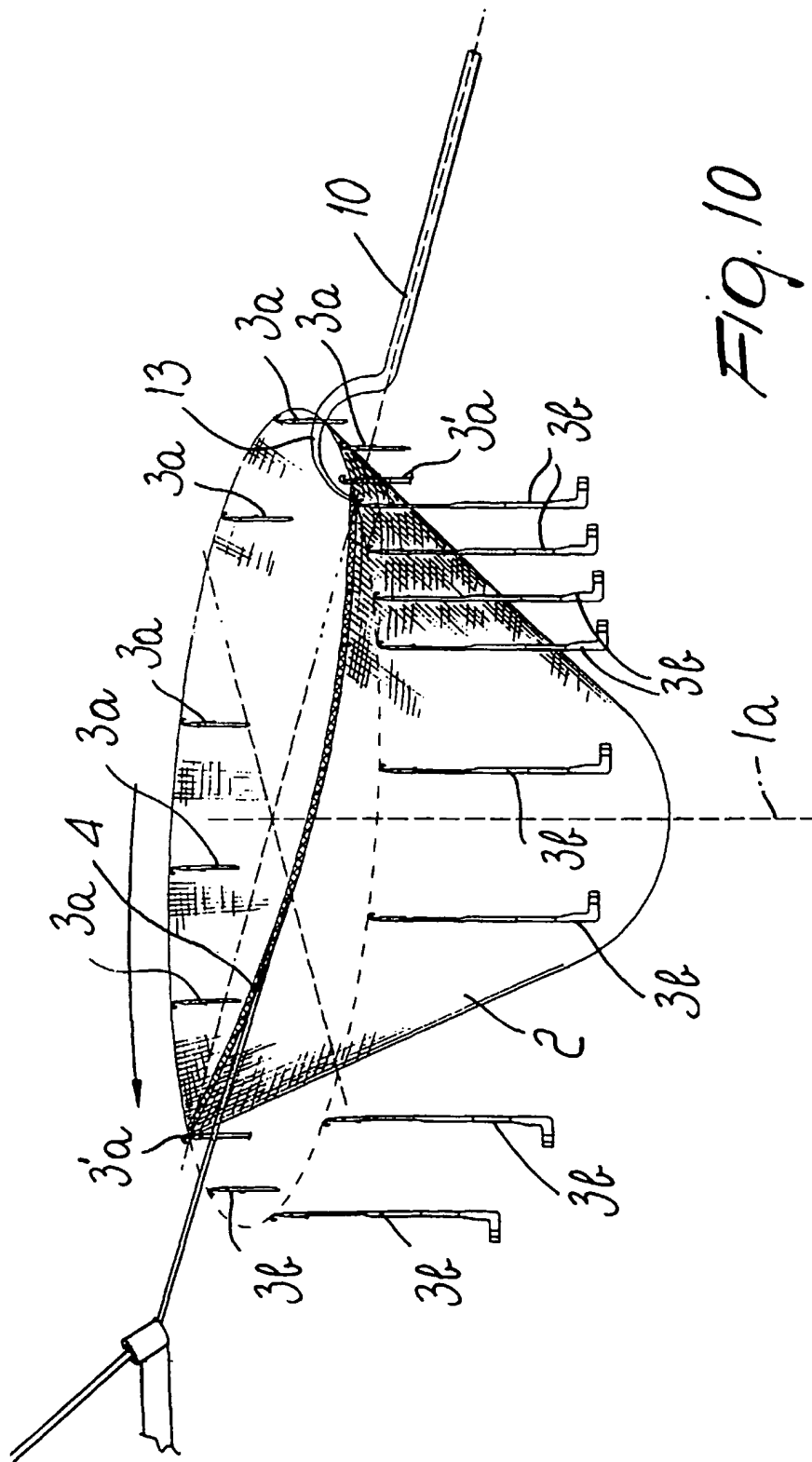


Fig. 9



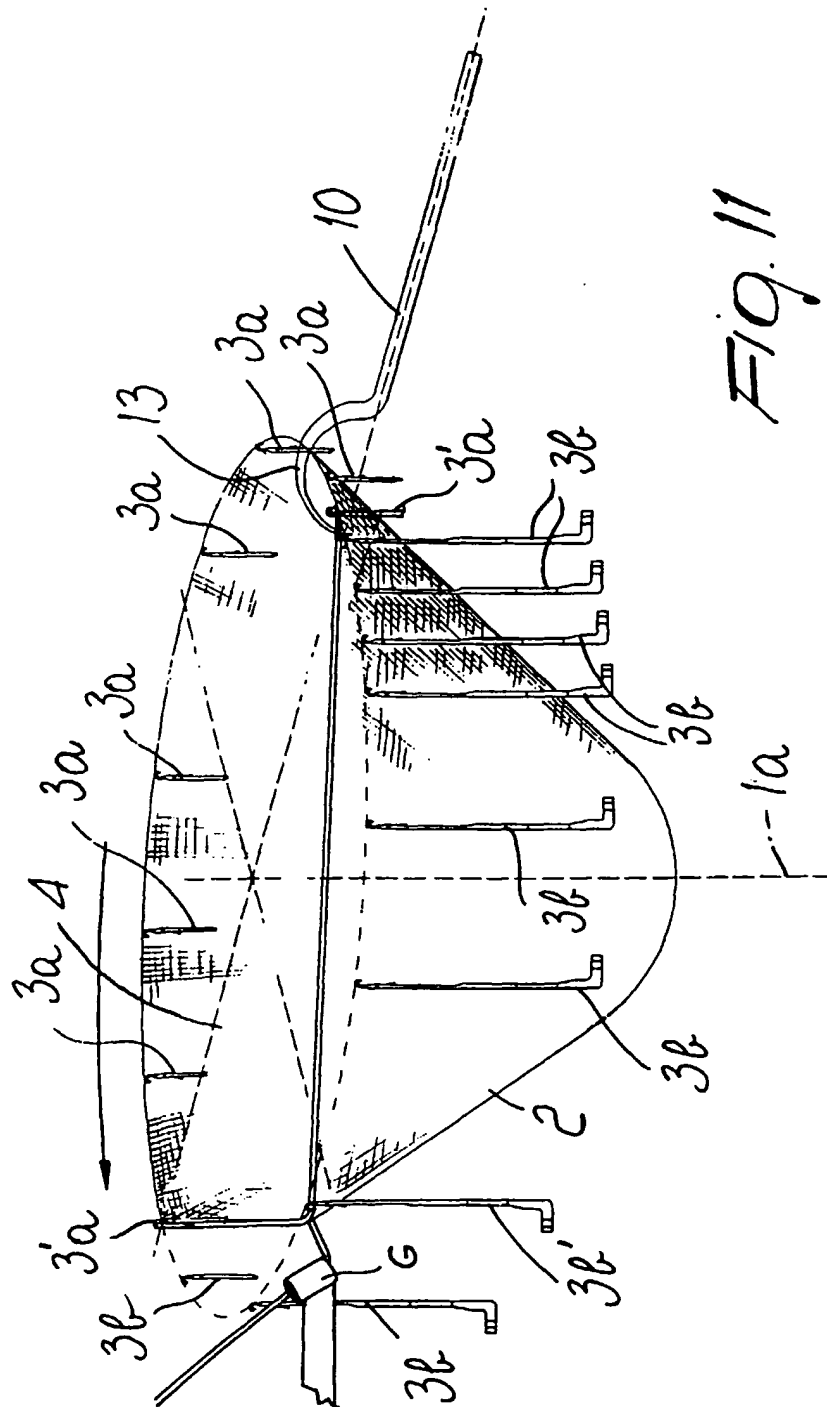


Fig. 11